

Novel Foul-Resistant Nano-Pervaporation Membrane for Medical Grade Water Generation, Phase I

Completed Technology Project (2006 - 2006)



Project Introduction

Extended-duration spaceflight requires self-sustained patient care capable for the treatment of emergency medical conditions, thus requiring medical grade water to reconstitute pharmacological substances when needed. Conventional method to produce medical grade water is either energy inefficient or too complex, requiring high pressure and using considerable consumables. We propose a novel foul-resistant nano-pervaporation (NVP) membrane with minimized mass, volume, consumables, and power consumption for producing medical grade water in both micro-g and sub-g environments. Our proposed concept is based on a near-room-temperature pervaporation process. The nano-pore selectively adsorbs liquid water and excludes other undesirable constituents in the portable water, such as particles, microbes, virus, and volatile organic compounds. The permeated water vapor is subsequently condensed allowing the heat of evaporation to be recovered. This smart system uses space vacuum to obtain low vapor pressure, together with a build-in heat recovery, aims at minimizing the required power. This membrane is foul-resistant. It only requires a low pressure gradient to achieve high water flow rate, minimizing the driving force for fouling. Also, without any moving part, the system enjoys low maintenance. The NPV process shows potentially the lowest amount of power consumption, mass/volume, and consumables among possible technologies for producing medical grade water.

Anticipated Benefits

Potential NASA Commercial Applications: Potential non-NASA applications for the proposed nano-pervaporation membrane and process include dehydration of esterification reaction (e.g. biodiesel production), dehydration of azeotropic mixtures (e.g. ethanol/water), and dehydration of heat sensitive compounds (e.g. pharmaceuticals).



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

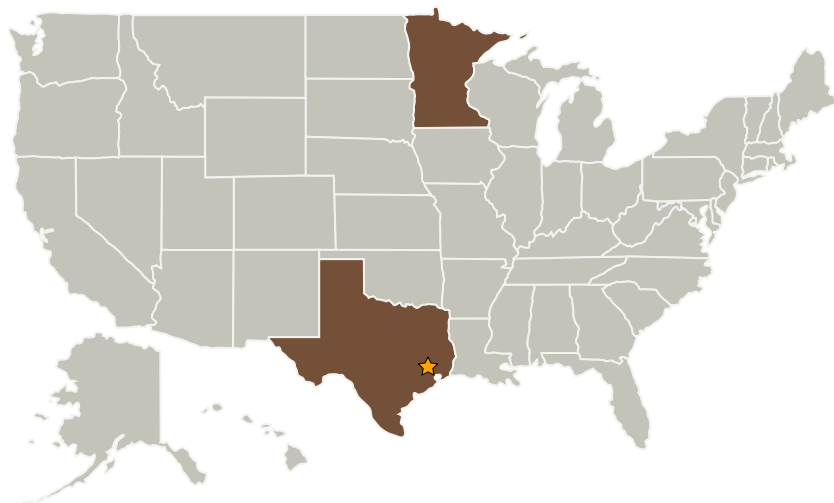
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
T3 Scientific LLC	Supporting Organization	Industry	Arden Hills, Minnesota

Primary U.S. Work Locations

Minnesota	Texas
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Chung-yi Tsai

Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - ↳ TX07.1 In-Situ Resource Utilization
 - ↳ TX07.1.3 Resource Processing for Production of Mission Consumables